PERMIT COUNTER
PUBLICATION NUMBER 280

(Revised October,1990)

DESIGN GUIDELINES FOR PUBLIC STORM DRAIN FACILITIES

This handout explains the standard criteria to be used by civil engineers for the design of public storm drain facilities. These guidelines are general and will not necessarily be applicable in all cases. The guidelines may be modified by Seattle Engineering Department Plan Review staff as required.

For Standard Plans of drainage system components, see City of Seattle Standard Plans for Municipal Public Works Construction, available from the Information Counter, 9th Floor, Seattle Municipal Building, or call 684-5349.

DESIGN CRITERIA

Pavement Replacement

1. Street and sidewalk pavement removal and replacement must follow the current Board of Public Works policy ("Street and Sidewalk Pavement Opening and Restoration Rules"). This policy currently requires full panel replacement for concrete pavement.

Storm Drain Location

2. Storm drains must be placed in the standard location according to Standard Plan 030, whenever possible. This standard location is seven feet south or west of the right-of-way centerline. It is desirable to place the storm drain on the high side of the street if it is not placed in the standard location. The Plan Review Section of the Seattle Engineering Department must approve alternate alignments.

Cover

3. Storm drains must have at least six feet of cover over the top of the pipe and be as deep as necessary to drain the surrounding area.

Storm Water Runoff Calculations

4. Storm water runoff must be calculated using the Rational Formula and the attached rainfall intensity table unless the Engineering Department approves use of another method for a particular project. An initial time of concentration of ten minutes is generally used. Pipe capacities must be calculated using Mannings Equations. The coefficient of runoff "C" shall be 0.5 for single family residential, 0.6 for mixed residential, 0.7 for commercial, 0.8 for industrial, 0.9 for the downtown Central Business District. For large undeveloped areas, parks, and golf courses, 0.3 may be used.

The ultimate future development under present zoning must be assumed when assigning "C" factors. Storm drains must be designed to collect runoff from the entire upstream drainage basin. A Mannings roughness coefficient "n" of 0.013 must be used for all pipe materials (concrete, ductile iron pipe, polyethylene, polyvinyl chloride (PVC)), unless otherwise approved by the Seattle Engineering Department. Calculations to determine the capacity of existing corrugated metal pipe shall use an "n" of 0.024.

The Engineering Department may approve the use of a computer modeling program, such as "SWMM," to calculate storm water runoff for a particular project. The use of "SCS" and "SBUH" models is usually not allowed.

Design Storm

5. Storm drains must be designed for full gravity flow for 10-year storm design conditions. The storm drain's surcharge level (hydraulic grade line) for a 25-year rainfall event may be no higher than four feet below the street's gutter elevation or one foot below the service elevation of adjacent private property, whichever is lower. The service elevation is defined as two feet below the lowest elevation served on the site (such as the lowest catch basin or footing drain) minus a one percent slope from the location of the low point to the storm drain.

6. If calculations show that a storm drain is surcharged during a storm with a return frequency of 25 years or less, the Hydraulic Grade Line must be shown on the pipe profiles of the contract drawings. Use the high water elevation of the receiving waters to calculate hydraulic gradients. High water for Lake Union and Lake Washington is +9.0; for Elliott Bay and the Duwamish River it is +2.0 (City Datum).

Size and Slope of Pipes

7. Storm drains must be a minimum of 12 inches in diameter. The minimum slope for storm drains is 0.5% with 1.0% being desirable. Flatter slopes will be considered on large diameter pipe. Pipe slope must achieve a minimum velocity of three feet per second (fps).

Excess Energy

8. The effects of excess energy shall be investigated whenever pipe velocity exceeds 20 feet per second (fps). Energy dissipation features may be required.

Matching Pipe at the Manholes

9. The crowns of all pipe shall match at the manholes. Invert elevations shall be calculated by projecting the pipe slopes to the center of the manholes.

Intersections, Alleys, and Crosswalks

10. Drainage shall be collected at all closed contour low points along the roadway, upstream of all intersections and crosswalks, and at the downstream end of developed alleys upstream of the sidewalk. If the distance from a high point to the intersection, crosswalk, or end of an alley is less than 100 feet, drainage pickup may not be necessary.

Flat Arterials

11. Arterial streets with a grade flatter than 1.0% shall have drainage pickups (catch basins and/or inlets) at least every 350 feet.

Pipe Material

12. Concrete pipe is the standard material for storm drains. Ductile iron may be used where a stronger pipe or restrained joints are needed. PVC or polyethylene may be allowed pending evaluation of soils data and design criteria. The use of PVC or polyethylene requires specific Seattle Engineering Department approval.

Manholes

13. Manholes are required every 400 feet on pipe 24-inches in diameter or smaller, and every 600 feet on pipe larger than 24-inches in diameter. Generally, manholes are required at pipe junctions, breaks in grade, and changes in horizontal alignment. When a small diameter storm drain intersects a very large diameter storm drain, it may be appropriate to set the manhole on the small diameter pipe 10 to 30 feet away from the junction. Manholes are needed at the end of all pipe runs unless the pipe is 100 feet in length or shorter.

14. Storm drains may have one horizontal or vertical bend between manholes, subject to approval by the Seattle Engineering Department.

15. Manholes must be placed near intersections to allow for future extensions into side streets. Stubs to the side streets shall be used to facilitate catch basin connections (see details 1 and 2). Slope and depth of the stubs must allow future extension farther into the side streets.

16. Manholes must be located using stations and offsets or dimensions from street centerlines or established Seattle Engineering Department monument lines. Manhole numbers shall start at the downstream end.

Catch Basins and Inlets

17. In alleys, use a Standard Plan 241 catch basin.

18. Along streets, use Standard Plan 250A inlets and Standard Plan 242A catch basins. (See detail 1.)

19. If utility interferences prevent the use of a Standard Plan 242 catch basin along a curbline, place a Standard Plan 250 inlet along the curb and connect to a Standard Plan 240A catch basin. Locate the Standard Plan 240A catch basin in the first lane of traffic as close to the curb as practical, so only one lane must be closed to traffic for maintenance. (See detail 3.)

20. Water from no more than 1000 total lineal feet of curb may discharge into one catch basin. This includes the length of curb for inlets which discharge into a catch basin as well as the catch basin itself. (See detail 2.)

21. The standard location for inlets and catch basins is one and one-half feet from the centerline of the inlet or catch basin to the point of curvature (P.C.) or point of tangency (P.T.) of the curb return (see Standard Plan 260a and item number 23 below).

22. At closed-contour low points and other locations where extra capacity is needed, use Standard Plan 242B catch basins and Standard Plan 250B inlets. At low points in the roadway use two Standard Plan 242B catch basins, one on each side of the street, each with an independent connection to the storm drain.

23. Inlet and catch basins must be located upstream of curb ramps and crosswalks. The downstream edge of the inlet grate must be a minimum of one foot clear of the curb ramp landing. It is desirable to have the downstream edge of the inlet grate placed at the upstream edge of the curb ramp wing. See Standard Plan 422b for location of new curb ramps.

24. Existing catch basins and inlets must be replaced if located in areas where new permanent pavement will be installed. Existing inlets which do not conform with Standard Plan 250, located along new curbs, must be replaced. Whenever a catch basin or inlet is replaced, the connection pipe to the catch basin or mainline must be replaced. Reconnect existing catch basins to the mainline using new pipe.

25. Catch basin and inlet connections must be 8-inch diameter concrete pipe. A catch basin connection to an existing 8-inch public sewer may be 6 inches in diameter.

26. The maximum length of an inlet connection is 35 feet.

Existing Service Drains and Outlets

27. Existing service drains and outlets from detention systems located on private property must be connected to a new storm drain when feasible.

Roadway Grade

28. The minimum allowable roadway grade is 0.5% with 1.0% being desirable. The minimum roadway cross slope is 2.0%.

Curbs and Gutters

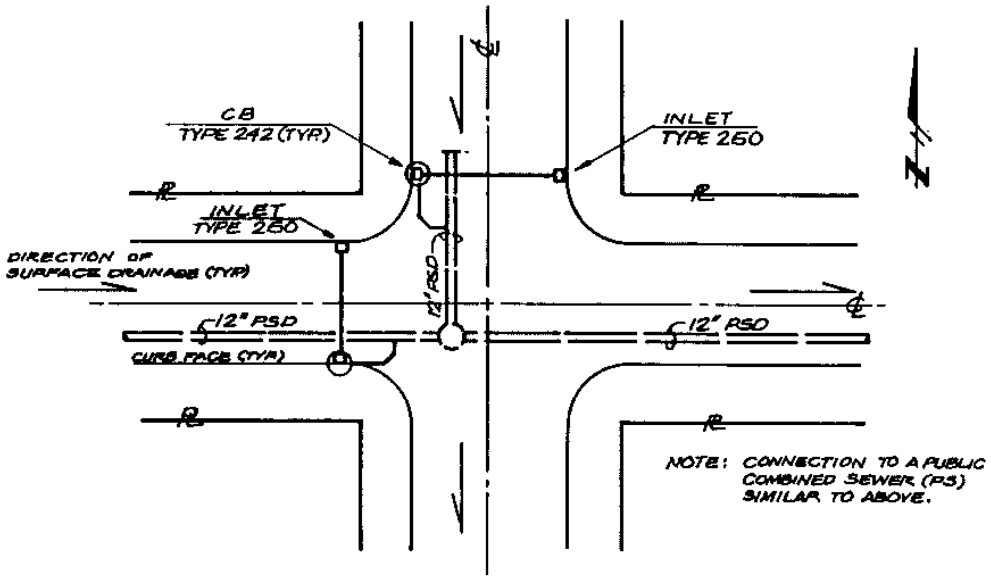
29. Generally, a Standard Plan 410B curb and gutter must be used with asphalt paving and a Standard Plan 410C doweled curb must be used with concrete paving. In most instances, a joint between the curb and roadway, in a gutter section carrying runoff, is unacceptable.

Rainfall Frequency - Intensity - Duration Tabulation for Seattle Washington

Duration Minutes	Intensity, Inches/Hour For Given Recurrence Interval					
	1 year	5 year	10 year	25 year	50 year	100 year
5	0.84	1.80	2.23		3.13	3.54
6	0.76	1.66	2.08		2.91	3.30
7	0.70	1.54	1.92		2.72	3.10
8	0.66	1.44	1.80		2.57	2.91
9	0.63	1.36	1.70		2.41	2.73
10	0.60	1.30	1.62	1.99	2.29	2.58
11	0.58	1.23	1.53	1.90	2.18	2.46
12	0.56	1.18	1.47	1.81	2.08	2.34
13	0.55	1.13	1.40	1.73	1.98	2.23
14	0.53	1.09	1.34	1.66	1.90	2.13
15	0.52	1.05	1.30	1.59	1.82	2.05
16	0.50	1.01	1.25	1.52	1.74	1.97
17	0.49	0.98	1.20	1.47	1.67	1.89
18	0.48	0.95	1.15	1.42	1.61	1.82
19	0.47	0.92	1.11	1.36	1.55	1.75
20	0.46	0.89	1.07	1.32	1.50	1.70
21	0.45	0.86	1.04	1.28	1.46	1.65
22	0.44	0.84	1.01	1.25	1.41	1.60
23	0.43	0.82	0.98	1.21	1.37	1.55
24	0.42	0.80	0.96	1.18	1.33	1.50
25	0.41	0.78	0.93	1.15	1.30	1.46
26	0.41	0.76	0.91	1.12	1.27	1.42
27	0.40	0.74	0.89	1.09	1.24	1.39
28	0.39	0.73	0.87	1.06	1.21	1.35
29	0.39	0.71	0.85	1.04	1.17	1.32
30	0.38	0.70	0.83	1.02	1.15	1.29
32		0.67	0.80	0.97	1.10	1.23
34		0.65	0.77	0.93	1.05	1.18
36		0.62	0.74	0.90	1.01	1.14
38		0.60	0.71	0.87	0.98	1.10
40		0.59	0.69	0.84	0.95	1.05
42		0.57	0.67	0.82	0.92	1.02
44		0.55	0.65	0.79	0.89	0.99
46		0.53	0.63	0.77	0.87	0.96
48		0.52	0.61	0.74	0.84	0.94
50		0.51	0.60	0.72	0.82	0.91
52		0.50	0.58	0.71	0.89	0.89
54		0.48	0.57	0.69	0.78	0.86
56		0.47	0.56	0.68	0.76	0.84
58		0.46	0.54	0.66	0.74	0.82
60	0.28	0.45	0.53	0.64	0.72	0.80
120	0.20	0.31	0.35	0.42	0.47	0.52
180	0.16	0.25	0.28	0.33	0.37	0.41

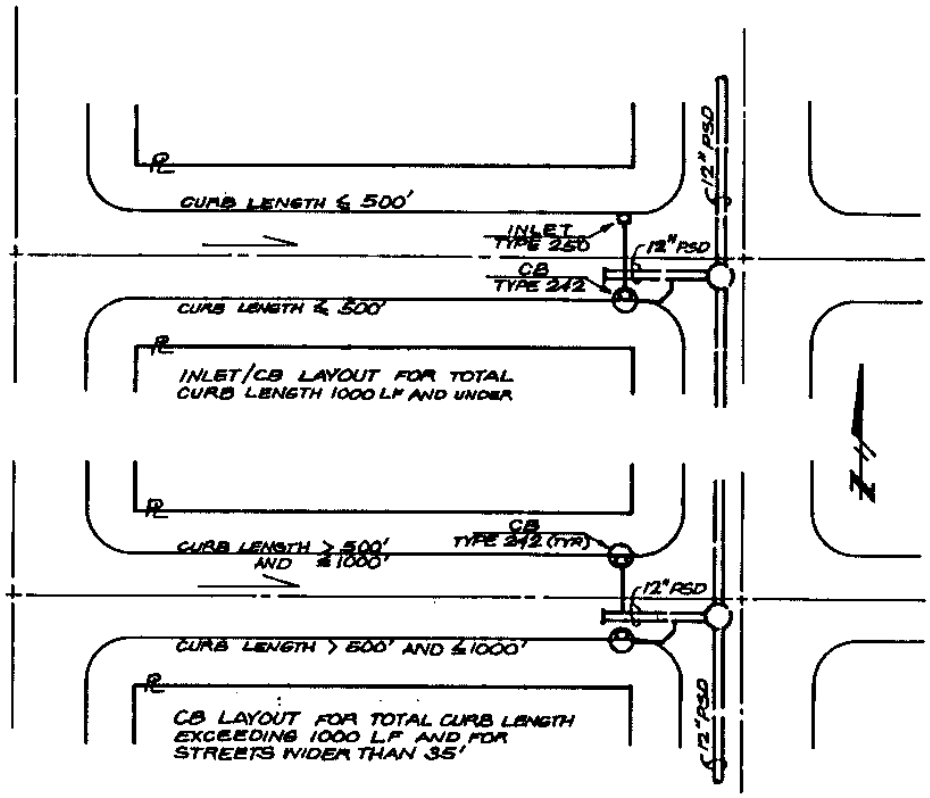
DRAINAGE AND SEWAGE EASEMENTS

Inside Diameter (Nominal Diameter) of pipe	Minimum Easement Width
<12"	12'
12"	12'
15"	12'
16"	12'
18"	14'
20"	14'
21"	14'
24"	14'
30"	16'
36"	16'
42"	18'
48"	18'
60"	20'
72"	24'
84"	28'
96"	32'
108"	36'
120"	40'
132"	44'
144"	48'



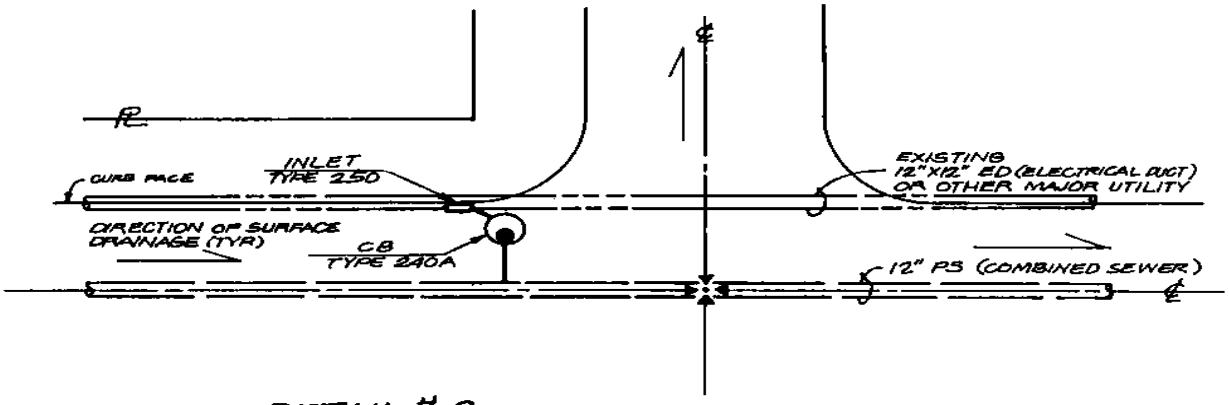
DETAIL #1 N.T.S.

TYPICAL INLET/CATCH BASIN LAYOUT AT AN INTERSECTION



DETAIL #2 N.T.S.

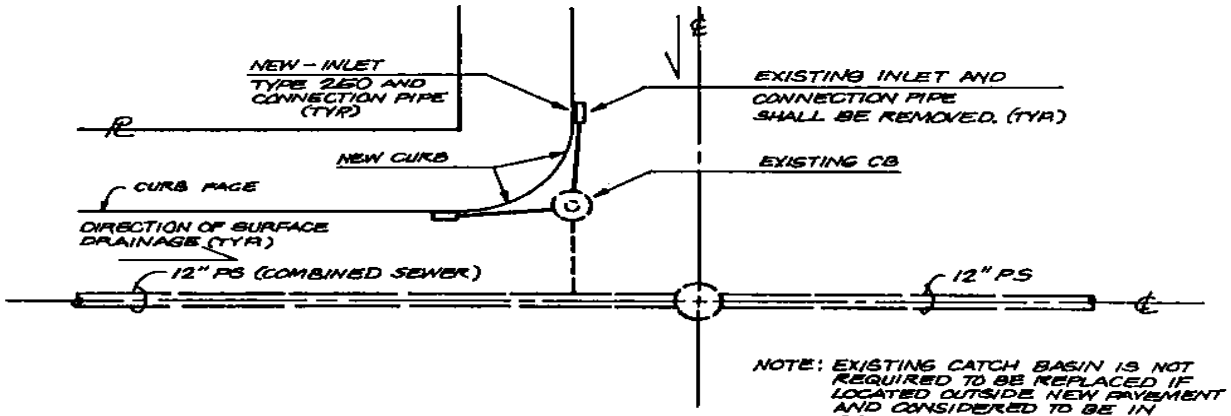
CATCH BASIN LAYOUTS ON LONG BLOCKS



DETAIL # 3 N.T.S.

ALTERNATIVE DRAINAGE FACILITY PLACEMENT

NOTE: TO BE USED ONLY WHEN MAJOR EXISTING UTILITIES CONFLICT STANDARD CB PLACEMENT.



DETAIL #4 N.T.S.

INLET REPLACEMENT ALONG NEW CURB